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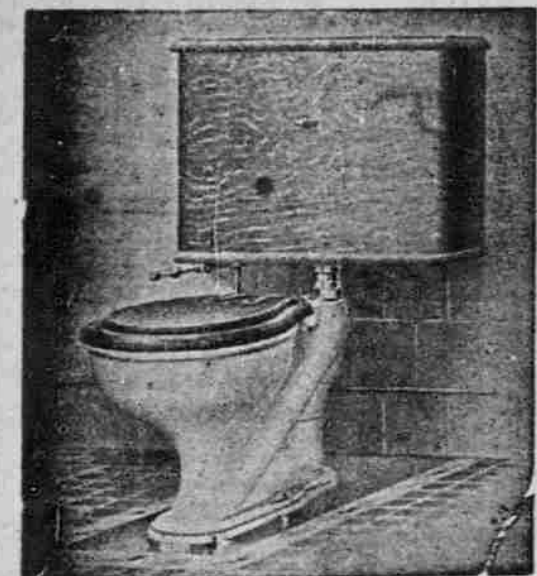
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THE KOOLAU DITCH COMPLETED ON MAUI



ROAD AND TUNNEL CROSSING WEST WAILUA.

On Friday the 16th of September, Governor Carter formally opened the great Koolau ditch on East Maui which collects all the Maui streams beyond Honomanu and conveys them to the Hawaiian Commercial, Haiku, Pala and Kihel plantations.

The conception of the project is due to the business foresight of the Hon. H. P. Baldwin and the late lamented S. T. Alexander who long ago saw the great benefits to be derived from converting to the uses of cultivation on the parched lands of Central Maui the many streams from this productive watershed, which aimlessly discharged by picturesque waterfalls into the sea over the many falls which flank the north slopes of Haleakala.

Messrs. Baldwin and Alexander built the Hamakua ditch on Maui in 1879. This project was a severe test not only of their courage but a strain on their financial resources. It, however, set an example in water development to the planters of the other islands which they have since followed with resulting profit.

HISTORY OF WORK.

Mr. O'Shaughnessy, C. E., was retained two years ago to make a preliminary survey and report of cost of the Koolau ditch. This was completed the 15th of February, 1903, and instructions to commence work was given in the early part of March; and ever since then to completion ten days ago the work has been vigorously prosecuted by a small army of Japanese miners and laborers. The natives and Chinese exhibit an aversion for this class of labor and could not be induced to work except as teamsters and boatmen. As the country traversed has heretofore been practically an inaccessible no man's land, about 18 miles of trail and 4 1-2 miles of wagon road had to be built preparatory to actual construction for the delivery of supplies.

The first tunnel was started the first day of April, 1903, and the last completed the 3rd day of September, 1904. Water flowing the whole length one week after.

KOOLAU DITCH.

This ditch is ten miles long measured by the direct route it takes cutting straight through the mountain spurs at the base of Haleakala, while the surface trail along its length measures 18 miles showing the great shortening in distance by substituting direct tunnelling for crooked surface ditch building. Owing to the steep falls in many places it would be impossible to build either a ditch or flume on the surface, hence the resort to tunnelling.

Of the entire length 39,282 feet is in rock tunnel, 10,179 feet in open ditch and 692 feet in redwood flume at the Nahiku end of the project. The tunnels are 8 feet wide in the clear, 7 feet high and when carrying a depth of 5 feet of water will carry over 85 million gallons daily.

There are 38 tunnels in all averaging 1040 feet in length, the longest being number 24, 2712 feet piercing the mountain between Honomanu and Keanae valleys. Various kinds of strata have been discovered in this extensive underground excavation from the hardest basalt pahoehoe, which generally sits in blankets 100 to 200 feet wide across ancient depressions, to the softest and most porous "a-a." One or two large caves have been discovered which lead toward Haleakala, while in tunnel 8 near Nahiku an underground river which had petrified wood and ancient tree roots was found. This caused considerable difficulty to

overcome for as fast as the excavation was made the liquid mud from the ancient river came pouring in. A shield of cemented masonry was finally put in with perforations to admit the water, and strong enough to resist the pressure of the adjoining masses, and no further trouble has been experienced.

METHOD OF DOING WORK.

After all the preliminaries were arranged the different tunnels were let out to various groups of Japanese contractors. These men worked three shifts of eight hours each with four men working in each face at one time. The ditch owners furnished tools, track and cars to transport the excavated material while the contractors supplied their own powder and candles. Over 200,000 lbs. of giant powder and 25,000 lbs. of candles were consumed in the work; besides seven miles of railroad track ties, etc.

The tunnel rate of excavation per month gradually increased from 408

feet for April, 1903, to 4655 feet for August, 1903, which was the greatest speed obtained.

Hand drills with 7-lb. and 4-lb. hammers were used together except in the case of tunnel 33 which proved to be a long stretch of the hardest basalt which required machine drills driven by compressed air to accelerate its completion.

CEMENT LINING.

As a great deal of the strata penetrated was found to be highly porous it was deemed advisable to line such sections with cement. This work was commenced and prosecuted as the shorter porous tunnels were finished, so that on the completion of the excavation of the last tunnel all the more leaky portions were sealed.

This work includes 16,000 lineal feet of concrete lining six inches thick and five feet high composed of the best cement made and tamped in place (by day's work) in the most careful manner. 778 feet of masonry lining five

feet high; 2,785 feet of cement side-plastering and 21,153 feet of three-quarter inch bottom plastering. Over 8,000 barrels of cement were used, and besides the plant of the Concrete Construction Company 134 animals were employed in delivering sand and cement and other material for this lining work.

KOOLAU DITCH WATERSHED.

The watershed intercepted by this work has from fifteen to twenty streams which will constantly flow into the ditch including all those between Keanae and Honomanu which carry a minimum in long droughts about forty million gallons daily, and in frequent flood times over two hundred million gallons. Keanae and Nahiku, owing to their peculiar geographical location on the windward base of Haleakala, are the wettest spots in the Hawaiian Islands, having an average rainfall of over 300 inches yearly. This is conserved by the grand forest coating on this side of Haleakala, which climb up to an elevation of 8,000 feet above sea level, and makes this rough side of Maui such an ideal watershed.

The waters of the Koolau ditch are distributed at its western terminus by a partition weir of nine panels; one-third to the Hawaiian Commercial and two-thirds to the new corporation, the Maui Agricultural Company, which includes the old Pala and Haiku plantations. For nearly half the year Kihel will be benefited by this work as when the other plantations can not use their excess of water it can be passed along to Kihel.

All the old ditches from the west end of the new one at Waikamoi gulch, 1,207 feet high, to the plantations will have to be enlarged and many new reservoirs made to store the surplus water conveyed, as on the very first day the new ditch carried water, over 100 feet of the old ones was broken away by the excessive additional volume, and had to be repaired.

ACCIDENTS, ETC.

A complete hospital was organized into which all the injured men were placed and cared for, and only two men of the 700 employed lost their lives through falling off paths before the trails were finished. Not one man died from tunnel or powder accidents due to premature explosions, which speaks well for the Japanese knowledge of explosives.

The Hon. H. P. Baldwin accompanied the Governor and Secretary Atkinson last Friday through a portion of the aqueduct before the formal opening and expressed his pleasure at the consummation of the project.

From the commencement Mr. M. M. O'Shaughnessy has been in charge as chief engineer and manager, with Mr. Jorgensen as his able assistant, while Rogers and Johnson have been lunas from start to finish.

Some more small streams have to be connected up with the Maui work, which will be accomplished in a few months, after which it is expected that the island of Maui will take its place as the banner cane producer of the Hawaiian Islands.

POWER PROPOSITIONS.

Mr. O'Shaughnessy is now engaged in preparing plans for utilizing the power from one-third water of the new Koolau ditch and all the water of the old H. C. & S. Co.'s (Spreckels) ditch, which united together and dropped just west of Waikamoi gulch to the level of the Lowrie ditch, will give about 2,700 horse-power. This will be utilized for driving some of the existing pumping stations and operating new ones in the Waikuku valley where the Hawaiian Commercial own extensive property interests now unutilized.

This work can be very economically done as the only extra expense to get the water power will be to install the pressure pipe to the water wheels.

Copies now on sale at all book stores of the Hawaiian Forester and Agriculturist, a monthly magazine of forestry, entomology and agriculture, issued under the direction of the Board of Commissioners of Agriculture and Forestry. Price 10 cents a copy, \$1.00 per year by mail to any address. Subscriptions received at the Gazette office.

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